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THE COMMONWEALTH OF MASSACHUSETTS

METROPOLITAN DISTRICT COMMISSION

GOVERNMENT DOCUMENTS

COLLEGE SEWERAGE DIVISION

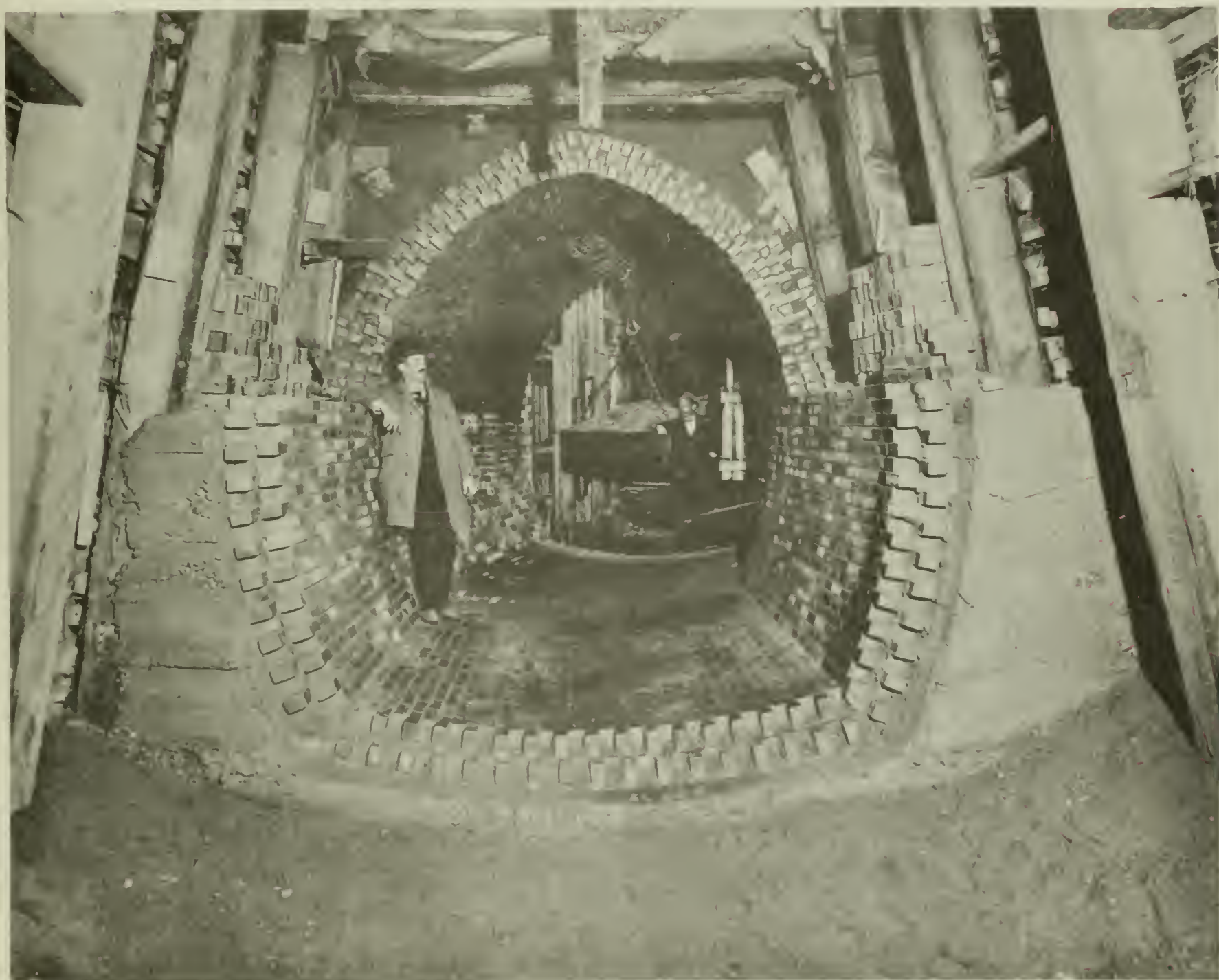
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FIFTY—SEVENTH ANNUAL REPORT



FISCAL YEAR ENDING - JUNE 30, 1976

M.D.C. HIGH LEVEL SEWER

This photo taken on December 28, 1900 shows excellent workmanship and design. The location is Section 72, Station 8 + 75 in West Roxbury at the intersection of the Arborway and South Street. The sewer was constructed in a tunnel through sand. The sewer is 35 feet below the ground surface.

The sewer was constructed using an 8 inch underdrain. A concrete invert was poured and lined with brick. A brick arch was then constructed and the space above the arch filled with concrete.

This sewer is still in service today as one of the main lines in the M.D.C. Sewerage Division.



The Commonwealth of Massachusetts
Metropolitan District Commission
20 Somerset Street, Boston 02108

SEWERAGE DIVISION

October 14, 1976

Metropolitan District Commission
20 Somerset Street
Boston, Massachusetts 02108

John F. Snedeker, Commissioner

Dear Commissioner

The Fifty-Seventh Annual Report of the Metropolitan District Commission, Sewerage Division activities for the fiscal year 1976 is being submitted for your review and general information.

If you or any one of your staff have questions or if my office can be of clarification on any points put forth in the report, please do not hesitate to notify us.

Respectfully submitted,

A handwritten signature in cursive script, reading "A. C. Hayes".

A. C. Hayes
Director of Sewerage Division
and Chief Sewerage Engineer

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ORGANIZATION

The following principals and assistants have been employed during the year:

Allison C. Hayes, Director of Sewerage Division
and Chief Sewerage Engineer

Andrew P. Fisichelli, Assistant Director of
Sewerage Engineering

D. Joseph Hamel, Associate Civil Engineer

Anna M. Quinn, Head Administrative Assistant

Robert J. Holthaus, Superintendent of Deer Island Sewage Treatment Plant

James W. Connell, Superintendent of Nut Island Sewage Treatment Plant

John P. Mullan, Superintendent of Pumping Stations

Francis L. Monahan, District Supervisor of Sewers (Ward Street Yard)

John W. Forrest, District Supervisor of Sewers (East Boston Yard)

As of June 30, 1976 there was an authorized staffing of five hundred and fifty-three (553) positions for the Metropolitan District Commission, Sewerage Division. This staffing is assigned to provide the collection, transport, pumping, treatment and disposal of waste waters on a continuous twenty-four per day basis and is grouped as follows:

Nine (9) positions assigned as supervisory/management.

Twenty-three (23) positions assigned as clerical.

Twenty-two (22) positions assigned to the preparation of facility rehabilitation, contracts, sewer relief design, and industrial programs as staff engineers.

Sixty-eight (68) positions assigned to the maintenance and care of sewer lines, appurtenances and buildings.

One Hundred and twenty-five (125) assigned as station supervisors, plant engineers, maintenance and operational personnel within the pumping service.

Three Hundred and six (306) assigned as plant engineers, technical, laboratory, operational and maintenance personnel within the waste water treatment service.

MAINTENANCE AND OPERATION

Scope of Work and Facilities

The Director of the Sewerage Division and Chief Sewerage Engineer has charge of the design and construction of new works, and the maintenance and operation of all the works controlled by the Metropolitan District Commission for removing sewage from forty-three municipalities comprising the Metropolitan Sewerage District.

The work includes the maintenance and operation of ten pumping stations, one storm water detention and chlorination plant, two waste water treatment plants, four pretreatment headworks and 225.57 miles of Metropolitan Sewers receiving the discharge from 5145.57 miles of town and city sewers at 1,812 points, together with the care and routine work of inspecting, cleaning and maintaining sewers, siphons, tide gates, outfall sewers, the inspecting of connections to Metropolitan Sewers, and the care of pumping stations, treatment plants, other building and grounds.

METROPOLITAN SEWERS

Sewers Purchased and Constructed and Their Connections

At the end of the year there was a total of 225.57 miles of Metropolitan Sewers in operation within the Sewerage District. Of this total 11.36 miles of sewer, with the Quincy Pumping Station, have been purchased from cities and towns of the district and the U. S. Navy.* The remaining 214.21 miles of sewers and other works have been constructed by the Metropolitan Boards.

The locations, lengths and sizes of these sewers are given in TABLE IV, together with other data referring to the public and special connections with the system.

GASOLINE IN PUBLIC SEWERS

A Sanitary Engineer is employed to inspect all newly constructed garages or other gasoline - using establishments to insure proper separators are installed and maintained. Occasionally, odors of gasoline are detected in the sewer and reported to the Department of Public Safety. A joint investigation and follow through are made to eliminate this hazard.

During the fiscal year 30 new separators were connected to the local sewers that discharge into the Metropolitan System, and 2 disconnected. There are according to our records, 4,422 separators in service at garages and other gasoline - using establishments.

MATERIALS INTERCEPTED AT THE SCREENS

The material removed from sewage at the screens of the Metropolitan Sewerage Stations, exclusive of the Ward Street, Chelsea, and Columbus Park Headworks consisting of rags, paper and floating materials has, during the year, amounted to 920 cubic yards.

* Hingham Force Main.

INDUSTRIAL WASTE

The industrial waste inspection program was started in April of 1974 to acquire supplemental information and data on those industries not responding to the questionnaire survey. It has been expanded to include all 43 cities and towns within the district.

The inspection program involves personal inspection of all industries in the district. Industries suspected of discharging a questionable waste are required to submit the results of analyses performed on samples of the process waste by an independent laboratory for review and evaluation. The results of analyses along with other pertinent information - (questionnaire data, inspection data and reports on the industry) - are used to determine whether or not the wastes are acceptable for discharge into the Metropolitan District Commission sewer system.

Inspections of industries in the areas of Walpole, Stoughton, Norwood, Canton, Reading, Westwood Ashland, Framingham, Natick, Wellesley and Dedham have been completed to date. Some of the industries in these areas are not connected to the sanitary sewer system at this time, however, these industries were inspected so that a complete record of potential discharges into the sanitary sewer system is available.

In addition to the industries in the aforementioned areas, all known metal platers and latex processors have been inspected throughout the district as well.

As a result of the information obtained by the questionnaire survey and expanded industrial inspection program, 1045 industries have been inspected, 85 of which were found to be in violation of Metropolitan District Commission's Rules and Regulations..., and are presently pretreating, implementing pretreatment and/or modifying their systems to comply with the established standards.

A random follow up inspection program has been instituted to insure that industries previously cited by the Division are either conforming to Commission requirements or are progressing towards this goal.

METROPOLITAN SEWERAGE SYSTEM

PUMPING STATION

Capacities and Results for Fiscal Year 1976

Alewife Brook Pumping Station:

At this station, there are three primary, 30" mixed flow pumps driven by 440 volt, three phase, 100 H. P., General Electric variable speed motors and one secondary 30" mixed flow pump driven by a 440 volt, three phase, 50 H. P., squirrel cage motor.

Contract capacity of 30" pumps	26 m.g.d. at 15' head
Contract capacity of 20" pump	12 m.g.d. at 17' head
Average quantity pumped per day	11,950,000 gallons
Maximum quantity pumped per day	53,000,000 gallons

Alternating current is furnished by the Boston Edison Company and the Town of Belmont.

Braintree-Weymouth Pumping Station:

At this station, there are three diesel engine driven horizontal centrifugal pumps. The Waukesha diesel driven pump is capable of lifting 20 m.g.d. against a head of 42 feet, the Enterprise diesel driven pump is capable of lifting 20 m.g.d. against a head of 40 feet and a Chicago pneumatic diesel driven pump is capable of lifting 20 m.g.d. against a head of 42 feet.

Average quantity pumped per day	20,000,000 gallons
Maximum quantity pumped per day	50,850,000 gallons

Charlestown Pumping Station:

At this station, there are three submerged centrifugal pumps being driven by Fairbanks-Morse diesel engines.

Contract capacity of one diesel engine driven pump . .	60 m.g.d. at 18' head
Contract capacity of two diesel engine driven pumps .	45 m.g.d. at 11' head
Average quantity raised per day	35,090,000 gallons
Maximum quantity raised per day	93,100,000 gallons

Deer Island Pumping Station:

This station was decommissioned on September 28, 1974. All personnel were reassigned.

East Boston Pumping Station:

At this station, there are four submerged centrifugal pumps, one driven by an Enterprise diesel engine, one by a uniflow type steam engine, and two by triple expansion steam engines of the Reynolds-Corliss type.

Contract capacity of diesel engine driven pump	100 m.g.d. with 19' head
Contract capacity of uniflow engine driven pump	60 m.g.d. with 24' head
Contract capacity of triple expansion engine driven pumps	45 m.g.d. with 19' head
Average quantity pumped per day	4,180,000 gallons
Maximum quantity pumped per day	48,000,000 gallons

East Boston Electric Pumping Station:

This station is equipped with one 400 H. P., 396 R. P. M., General Electric motor that drives a 50 m.g.d. vertical centrifugal non-clog DeLaval pump at a total head of 35.4 feet, and with one 600 H. P., 320 R. P. M., General Electric motor that drives a 75 m.g.d. vertical centrifugal, non-clog DeLaval pump at a total head of 38.5 feet. Alternating current, 4,160 volt, three phase, is furnished by the Boston Edison Company.

Hingham Pumping Station:

This station is equipped with three Fairbanks-Morse centrifugal pumps driven by 60 H. P., Fairbanks-Morse induction type, wound rotor, variable speed motor and its pumping range is from 375 g.p.m. at a head of 35 feet, to 1000 g.p.m. at a head of 126 feet. Alternating current, 440 volt, three phase, is supplied by the Town of Hingham.

Average quantity pumped per day	. . . . .	590,000 gallons
Maximum quantity pumped per day	. . . . .	2,730,000 gallons

Hough's Neck Pumping Station:

This station is equipped with two 6" vertical centrifugal pumps each capable of pumping 1000 g.p.m. at a head of 20 feet. The pumps are driven by two 10 H. P., 220/440 volt, three phase motors. Alternating current 440 volt, three phase, is furnished by the Nut Island Sewage Treatment Plant.

Quincy Pumping Station:

The plant at this station consists of two Fairbanks-Morse centrifugal pumps driven by two Fairbanks-Morse diesel engines and one Worthington centrifugal pump driven by an Enterprise diesel engine.

Contract capacity of Fairbanks-Morse pumps	20 m.g.d. at a head of 33'
Contract capacity of Worthington pump	12 m.g.d. at a head of 26'
Average quantity raised per day	9,030,000 gallons
Maximum quantity raised per day	17,630,000 gallons

Reading Pumping Station:

At this station, there are two submerged centrifugal pumps of 4 m.g.d. capacity at a 75 foot head, one driven by a General Electric 100 H. P., 440 volt, three phase electric motor and the other driven either by a Fairbanks-Morse 100 H. P., 440 volt, three phase electric motor or a standby Fairbanks-Morse diesel engine. Alternating current is furnished by the Town of Reading.

Average quantity pumped per day	2,950,000 gallons
Maximum quantity pumped per day	4,180,000 gallons

Squantum Pumping Station:

At this station, there are two centrifugal pumps, each capable of pumping 2800 g.p.m. at a head of 46'. One is driven by 60 H. P., three phase motor and the other by a 60 H. P., three phase motor, or in emergency, by an 80 H. P., Fairbanks-Morse diesel engine. Alternating current is furnished by the Massachusetts Electric Company.

Average quantity pumped per day	1,040,000 gallons
Maximum quantity pumped per day	3,060,000 gallons

SUMMARY

Average Daily Volume of Sewage Lifted at Each of the Ten
Metropolitan Sewerage Pumping Stations During the Year, as
Compared With the Corresponding Volumes for the Previous Year

PUMPING STATION	Average Daily Pumpage			During Year Per Cent
	1975 Gallons	1976 Gallons	Increase Gallons	
Alewife Brook	12,130,000	11,950,000	180,000	1.48 *
Braintree-Weymouth	17,780,000	20,000,000	2,220,000	12.49
Charlestown	44,410,000	35,090,000	9,320,000	20.99 *
East Boston	1,760,000	4,180,000	2,420,000	137.50
East Boston Electric	No Reading	---	---	---
Hingham	710,000	590,000	120,000	16.90 *
Hough's Neck	No Reading	---	---	---
Quincy	8,920,000	9,030,000	110,000	1.23
Reading	2,480,000	2,950,000	470,000	18.95
Squantum	920,000	1,040,000	120,000	13.04

*. Decrease

METROPOLITAN SEWERAGE OUTFALLS

The Metropolitan Sewerage District now has outfalls in Boston Harbor at ten points, five of which may discharge sewage from Deer Island, and five from Nut Island. Of the five from Nut Island, one is for digested sludge and the other for treated sewage.

The two main outfalls from Deer Island discharge near Deer Island Light. The other three Deer Island outfalls are for temporary use only.

The two main 60" outfalls from Nut Island Treatment Plant extend for a distance of about 6000 ft. from the Nut Island shore; the third, a 60" outfall, extends about 1400 ft. from the shore; the fourth, a 60" emergency outfall, extends 468 ft. from the shore; while the fifth, a 12" outfall used for sludge from the treatment plant, discharges at President Roads at the northeasterly end of Long Island, a distance of about 4.2 miles.

The average flow from the Deer Island Treatment Plant and its outfalls has been 329,000,000 gallons of sewage per 24 hours, with a maximum flow of 497,000,000 gallons per 24 hours.

The average flow from the Nut Island Treatment Plant and its outfalls has been 139,280,000 gallons of sewage per 24 hours, with a maximum flow of 208,950,000 gallons per 24 hours.

METROPOLITAN DISTRICT COMMISSION

Sewerage Division

Allison C. Hayes, Director and Chief Sewerage Engineer
Robert J. Holthaus, Superintendent

D E E R I S L A N D S E W A G E T R E A T M E N T P L A N T

A N N U A L R E P O R T

July 1, 1975 to June 30, 1976

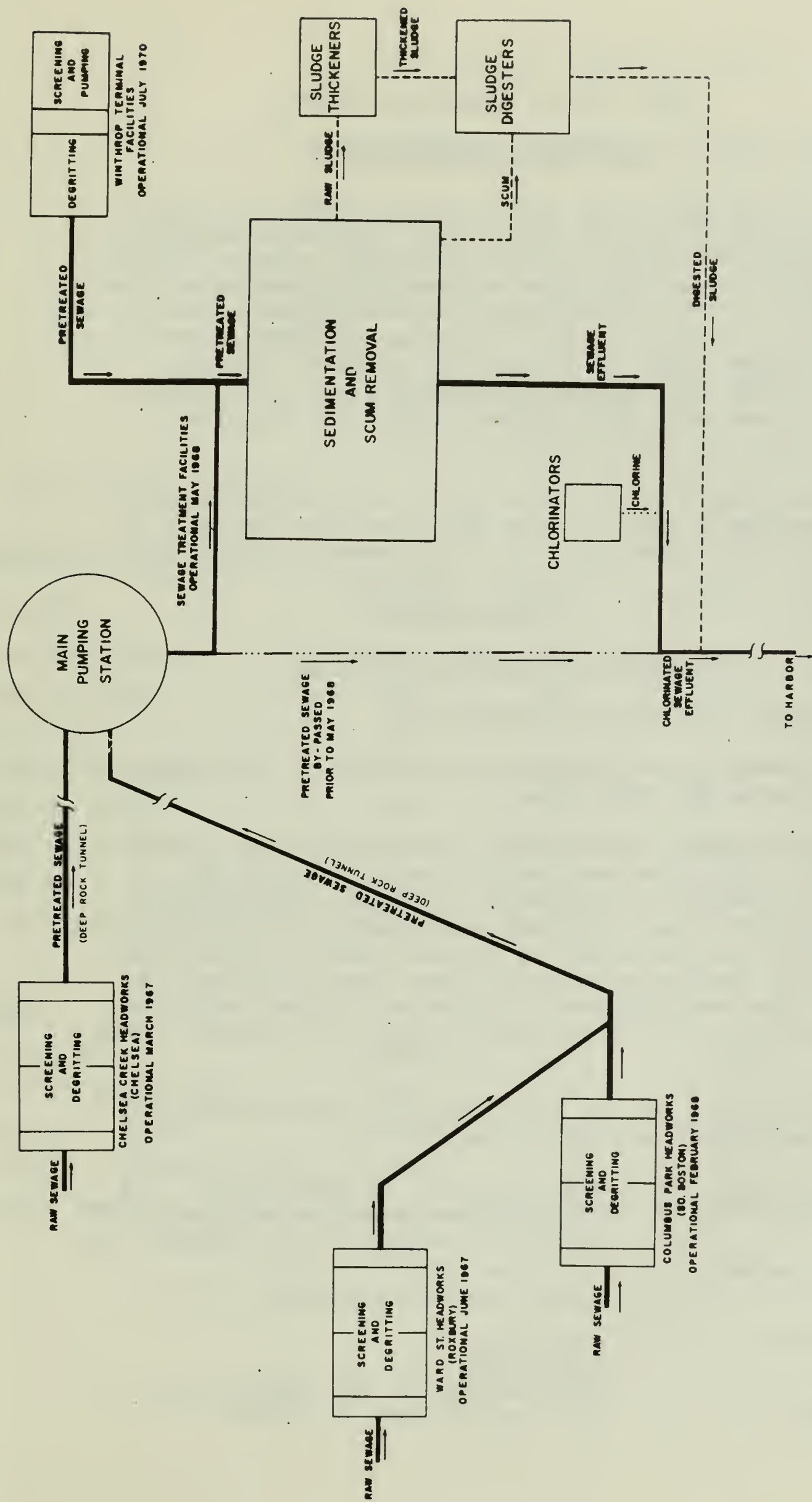
GENERAL INFORMATION

The Deer Island Treatment Plant, in operation since June 1968, serves 22 communities and portions of Boston, Brookline, Newton, and Milton. The area served by this treatment plant is 168.00 square miles with a total population of 1,390,709. Seven MDC pumping stations are located throughout the contributing area.

The relatively new water pollution control facility has been a major factor in improving the water quality in Boston Harbor by effectively accomplishing the design criteria of primary sedimentation and post chlorination of clarified sewage effluent.

As shown in the diagram on the following page, the Deer Island Facilities include three (3) remote headworks, each respectively located in Chelsea, Roxbury, and South Boston, and connected to the Deer Island main pumping station by two deep rock tunnels. The tunnel to the Chelsea Creek Headworks is approximately four miles and the one to Ward Street and Columbus Park Headworks is approximately seven miles long. An additional facility, the Winthrop Terminal Facilities, located on the main plant site, provides sewerage service for local areas and is connected to the Deer Island Plant through a separate direct pump discharge.

The treatment processes includes screening and grit removal (at all headworks) pre-chlorination; pre-aeration of the influent for a ten minute period; primary sedimentation; and post chlorination of the plant effluent prior to ocean discharge through two long submerged outfalls.



SCHEMATIC OF UNIT PROCESSES
HISTORY OF OPERATIONAL ACTIVITIES
DEER ISLAND TREATMENT PLANT
METROPOLITAN DISTRICT COMMISSION
FEBRUARY 20, 1969
REV JULY 1970

DEER ISLAND TREATMENT PLANT

GENERAL INFORMATION

Treatment of raw sludge is accomplished by separate sludge thickening prior to high rate digestion. Three primary digesters, equipped with fixed covers, external heaters, and draft tube mixers, have a sludge recirculation system via a common manifold. A fourth digester, also equipped with a fixed cover and a separate liquid recirculation system serves as a storage tank, receiving all primary digested solids and overflow to allow controlled discharge of digested material to sea only during the periods of outgoing tides.

Plant design and construction were under the jurisdiction of the MDC Engineering Division. The MDC Sewerage Division is responsible for plant operation and maintenance.

FISCAL 1976

HIGHLIGHTS OF MAJOR ACTIVITIES

This is the eighth full year of operations.

The use of effluent as process water in place of salt water has been continuous for this year.

Digester heating/recirculating pumps were replaced by more efficient units. Gas compressors are being altered for single-stage operation to eliminate a chronic maintenance problem. A process water pump has been installed for emergency use to back up the existing Process Water Pumping Station. The M.I.T. Radiation Facility has been built and is operational. Fire extinguisher systems are being installed in the exhaust pipes of the Nordberg engines to control stack fires.

Personnel staffing for the 24 hour/day continuous operation of the plant facilities are as follows:

<u>Operations</u>	Pre-treatment (Headworks): 64
	Primary Treatment (Main Plant): 30
	Power and Pumping (Main Plant): 21
Maintenance	Treatment Units: 31
	Power and Pumping Units: 35
Office	Clerical: 2
	Laboratory 5
	Administration and Engineering: 7
Total	195 (as of June 30, 1976)

DEER ISLAND TREATMENT PLANT

HIGHLIGHTS OF MAJOR ACTIVITIES (cont'd)

Approximately 1,800 visitors were given conducted tours of the plant this year. Any organization is welcome and requests from groups representing local, national, and international associations are becoming more frequent as the concern for the environment grows.

SUMMARY OF OPERATIONAL DATA

July 1, 1975 to June 30, 1976

I SEWAGE FLOW PROCESS

Headworks - Pretreatment

<u>Flows, mgd</u>	<u>Chelsea Creek</u>	<u>Columbus Park</u>	<u>Ward Street</u>	<u>Winthrop Facility</u>	<u>Totals</u>
Minimum Hrly Rate	45	35	50	0	
Minimum 24 Hour	92	46	77	1	
Average Daily	151	65	106	7	329
Average Daily (Design)	(140)	(66)	(113)	(24)	(343)
Maximum 24 Hour	248	114	154	50	
Maximum Hrly Rate	258	185	205	60	
Maximum Hrly Rate (Design)	(350)	(182)	(256)	(60)	
Total for Year - MG	55,069	23,761	38,715	2,485	120,030

Removals

Grit - Cu Ft	15,042	9,564	15,655	806	41,067
Grit - Cu Ft/Mil Gal	0.27	0.40	0.40	0.32	0.34
Screenings - Cu ft	41,219	13,679	36,460	4,607	95,965
Screenings - Cu Ft/Mil Gal	0.75	0.58	0.94	1.85	0.80

*Includes amounts from dewatering sedimentation tanks.

DEER ISLAND TREATMENT PLANT

Main Plant - Primary Treatment (cont'd)

Flows, mgd

Minimum Hourly Rate	130
Minimum 24 Hour	244
Average Daily	329
Average Daily (Design)	(343)
Maximum 24 Hour	497
Maximum Hourly Rate	580
Maximum Hourly Rate (Design)	(925)
Total for Year - MG	120,030

Suspended Solids

Influent - ppm	135
Effluent - ppm	74
Removal, %	45
Removal, lbs/day	167,000

Grease, Petroleum ether solubles

Influent - ppm	27.8
Effluent - ppm	15.7
Removal, %	44
Removal, lbs/day	33,160

Settleable Solids

Influent - ml/l	5.1
Effluent - ml/l	0.9
Removal %	82

BOD, 5 Day

Influent - ppm	136
Effluent - ppm	95
Removal, %	30
Removal, lbs/day	112,000

DEER ISLAND TREATMENT PLANT

Main Plant - Primary Treatment (cont'd)

Bacterial Concentration

Influent - MF/100 ml	84,000,000
Effluent - MF/100 ml	700
% Kill	99.999

Chlorine Requirement

Influent - ppm	7.2
----------------	-----

Note: The chlorine requirement fluctuates greatly because of significant salt water infiltration occurring at high tides

Chlorine Usage

Applied - ppm	9.0
Average Daily, tons	12.3
Total for year, tons	4502

Chlorine Residual

Effluent - ppm	0.4
----------------	-----

II SLUDGE COLLECTION AND DIGESTION PROCESSES

Raw Sludge

Total solids content % after thickening	6.7
---	-----

Added to Primaries

1000 gallons	112,000
1000 dry lbs.	62,500

Volatile solids content, %	70.7
, 1000 dry lbs.	44,200

Grease, skimmings excluded, pet. ether solubles

Content, %	15.2
Added to primaries, 1000 dry lbs.	9,500
Alkalinity	620
pH	6.0

DEER ISLAND TREATMENT PLANT

Sludge Collection and Digestion Processes (cont'd)

Digested Sludge

Total solids content %	3.7
Withdrawn, 1000 gals	118,000
, 1000 dry lbs.	36,400
Volatile solids content %	47.8
Withdrawn, 1000 dry lbs.	17,400
Alkalinity	2,400
pH	7.2

Digestion Efficiency

Reduction

Total solids destroyed %	42
1000 dry lbs.	26,100
Volatile solids destroyed %	61

Digester Loadings

Based upon operation using three (3) primary tanks (6.4 MG capacity)

Detention Time, days	21
Unit loading rate, dry lbs/cu ft/day	0.20

Digester Sludge Gas

Produced, total 1000 cu ft	250,093
cu ft/lb solid added	4.0
cu ft/lb volatile added	5.7
cu ft/lb solid destroyed	9.6
Quality Methane, %	63
Carbon Dioxide, %	37

Lime Usage

Total for year (tons)	NIL
Average usage/day (lbs)	NIL

Deer Island Treatment Plant

PRINCIPAL EQUIPMENT

Chelsea Creek Headworks

- 12-Sluice gates, self contained, hydraulically operated
 - 4 - 48" x 84" effluent
 - 4 - 60" x 96" influent
 - 2 - 96" x 72" sand trap connections
 - 2 - 48" x 72" weir overflow chambers
- 4-Fine bar screens 12'-0" wide by 10'-9" deep.
- 8-Grit collectors, two in each of four (4) channels.
- 8-Inclined screw conveyors, two in each of four (4) channels,
16-in. diam., 8-in. pitch screw, capacity of 2 cu. yds/hr. at
15 rpm.
- 4-Horizontal screw conveyors, one in each of four (4) channels,
12-in. diam., 12-in. pitch screw, capacity of 4 cu. yds./hr.
at 4 rpm.
- 4-Grit ejectors, pneumatically controlled, capacity of approximately
30 cu. ft. at 100 psi.
- 1-Grit storage hopper.
- 2-Dewatering pumping units, 700 gpm against 40 ft. dynamic head
at 870 rpm.
- 6-Electric sump pumps, $\frac{1}{2}$ hp, 120 v, single phase, 60 cycle a-c,
discharges 3,000 gal/hr. at 10 ft. dynamic head.
- 1-Auxiliary gasoline generator, 200 kw, 250 kva, 120/208 volts,
3 phase, 60 cycle a-c, 1200 rpm.

Columbus Park Headworks

- 8-Sluice gates, self contained, hydraulically operated
 - 4 - 42" x 72" effluent
 - 4 - 48" x 72" influent
- 4-Fine bar screens 10'-6" wide by 8'-11" deep, mechanically cleaned
 $\frac{3}{4}$ in. clear opening.
- 8-Grit collectors, two in each of four (4) channels.

Deer Island Treatment Plant

PRINCIPAL EQUIPMENT

Columbus Park Headworks (Con'd)

- 8-Inclined screw conveyors, two in each of four (4) channels, 16-in. diam., 8-in. pitch screw, capacity of 2 cu. yds/hr. at 15 rpm.
- 4-Horizontal screw conveyors, one in each of four (4) channels, 12-in. diam., 12-in. pitch screw, capacity of 4 cu. yds/hr. at 4 rpm.
- 4-Grit ejectors, pneumatically controlled, capacity of approximately 30 cu. ft. at 100 psi.
- 1-Grit storage hopper.
- 4-Screenings ejectors, pneumatically controlled, capacity approximately 12 cu. ft. at 100 psi.
- 1-Screening storage hopper.
- 2-Dewatering pumping units, 700 gpm against 15 ft. total dynamic head at 870 rpm.
- 6-Sump pumps, $\frac{1}{2}$ hr., 120 v, single phase, 60 cycle a-c, discharges 3000 gal/hr. at 10 ft. dynamic head.
- 1-Auxiliary diesel generator, 200 kw, 250 kva, 120/208 volts, 3 phase, 60 cycle a-c, 1200 rpm.

Ward Street Headworks

- 8-Sluice gates, self contained, hydraulically operated
 - 4 - 42" x 72" effluent
 - 4 - 48" x 84" influent
- 4-Fine bar screens 10'-6" wide by 9'-4" deep, mechanically cleaned, $\frac{3}{4}$ -in. clear opening.
- 8-Grit collectors, two in each of four (4) channels.
- 8-Inclined screw conveyors, two in each of four (4) channels, 16-in. diam., 8-in. pitch screw, capacity of 2 cu. yds/hr. at 15 rpm.

Deer Island Treatment Plant

PRINCIPAL EQUIPMENT

Ward Street Headworks (Cont'd)

- 4-Horizontal screw conveyors, one in each of four (4) channels, 12-in. diam., 12-in. pitch screw, capacity of 4 cu. yds/hr. at 4 rpm.
- 4-Grit ejectors, pneumatically controlled, capacity of approximately 30 cu. ft. at 100 psi.
- 1-Grit storage hopper.
- 4-Screenings ejectors, pneumatically controlled, capacity of approximately 12 cu. ft. at 100 psi.
- 1-Screening storage hopper.
- 2-Dewatering pumping units, 700 gpm against 15 ft. total dynamic head at 870 rpm.
- 6-Electric sump pumps, $\frac{1}{2}$ hp, 120 v, single phase, 60 cycle a-c, discharges 3000 gal/hr. at 10 ft. dynamic head.
- 1-Auxiliary diesel generator, 200 kw, 250 kva, 120/208 volts, 3 phase 60 cycle, 1200 rpm.

Main Pumping Station

- 9-12 cylinder, two cycle radial, dual fuel type engines.
Bore and stroke 14" x 16" with a speed range of 250-400 rpm.
2,125 bhp at 400 rpm. Engines are automatically controlled through governors from pump control equipment.
- 9-Non clogging, vertical, single end suction, mixed flow, centrifugal sewage pumps, rated capacity at 400 rpm, 90 mgd and a total dynamic head of 105 ft.
- 1-Graphic control room, tunnel-pump control system, microwave and telemetry instrumentation, complete sewage flow indicating and recording equipment, remote outfall gate controls.

Deer Island Treatment Plant

PRINCIPAL EQUIPMENT

Winthrop Terminal Facilities

The Winthrop Terminal Facilities began its initial operation under Deer Island Treatment Plant personnel during October 1970.

4-Sluice gates

- 3- 48" x 96" motor operated screen chamber influent
- 1- 48" x 48" motor operated, wet well

10-Slide gates

- 4- 48" x 126" motor operated, screen chamber effluent
- 2- 72" x 46" motor operated, grit chamber influent
- 1- 72" x 46" manually operated, by-pass inlet
- 1- 72" x 60" manually operated, by-pass outlet
- 2- 60" x 70" motor operated, grit chamber effluent
- 3-Coarse bar screens, 4'-0" wide by 9'-6" deep, mechanically cleaned, $3\frac{1}{2}$ in clear opening.
- 3-Fine bar screens, 4'-0" wide by 9'-6" deep, mechanically cleaned, $3/4$ -in clear opening.
- 2-Elevating grit collectors, one in each of two (2) chambers.
- 1-Horizontal grit screw conveyor, 9-in. diam., capacity of 200 cu ft/hr.
- 1-Screening discharge hopper, capacity of approximately 12 cu ft.
- 2-Electric sump pumps, each having a capacity of 30 gpm against a total dynamic head of 25 ft.
- 4-Electric driven, vertical non clogging, single end suction, centrifugal or mixed flow type pumps, each with a capacity of 10,400 gpm at 600 rpm against a total dynamic head of 30 ft.
- 2-Diesel driven pumps, each capable of pumping 74 mgd (currently being installed).
- 3-Aeration blowers, 75 hp, 550 rpm, each having a capacity of 1700 cu ft/min.
- 2-Grit chamber blowers, 15 hp, 900 rpm each having a capacity of 100-270 cu ft/min.
- 2-Ejector air compressor, 25 hp, 870 rpm, two stage, three cylinder, 142 cu ft/min piston displacement.
- 2-Instrument air compressors, 15 hp, 675 rpm, single stage, one cylinder, 98 cu ft/min piston displacement.

Deer Island Treatment Plant

PRINCIPAL EQUIPMENT

Main Power Plant

5-8 cylinder, four cycle, in line, dual fuel type engines rated at 998 hp, at 514 rpm. Drives 700 kw, 875 kva generators at 514 rpm.

5-Maxim heat recovery silencers. Generates steam at 15 psi under full automatic operation.

3-Boilers, each with a rated pressure of 15 psi.

1 - 300 hp, input 12,000,000 BTU/hr.
80% efficient, output 9,600,00 BTU/hr.
Converted for operation using sewage gas for fuel.

2 - 350 hp, input 14,000,000 BTU/hr.
80% efficient, output 11,200,000 BTU/hr.

Metering

9- Low-loss venturi meters 60" x 38".

Pre-Aeration System

2-Aeration channels, each 400' x 20' x 14'
44 swing air diffusers @ 0.02 cu. ft./gal
Detention Time - 10 minutes

Sedimentation

8-Sedimentation tanks, 245' x 100' x 10' with traveling bridge type collectors.

Detention period - 60 minutes

Scum collection by traveling bridge collectors with chain cross-collectors which return grease to a collection pit by gravity flow at the effluent end of sedimentation tanks, then pumped to scum concentration tanks.

4-Raw sludge pumping stations - each equipped with three (3) Wemco pumps with variable speed magnetic drive to 800 gpm at 45 ft. tdh.

2-Raw scum Wemco pumps, 1400 gpm at 30 ft. tdh.

Deer Island Treatment Plant

PRINCIPAL EQUIPMENT

Sludge Thickeners

- 4-Sludge thickening tanks, 55 ft. diam., 9 ft. sw depth, equipped with rotating scraper blades, then depositing sludge in sludge hopper at center of tank for transfer to digesters at 5% solid.
- 4-Thickened sludge pumping stations - each equipped with two (2) 100 gpm positive displacement plunger pumps, with vari-drive speed control.

Scum Concentration Tanks

- 2-Scum concentration tanks, 26' x 12' x 8.5' total capacity 39,800 gals.
- 2-1000 gpm centrifugal pumps for transfer of concentrated scum to digesters.

Digester Building

- 3-Primary digestion tanks - 108 ft. diam. x 30 ft. sw depth, capacity 2,130,000 gals each. Fixed covers with continuous recirculation of contents by draft tubes, heated by external heat exchangers.
- 1-Storage tank same size and capacity. Fixed cover and heated by external heat exchangers. Recirculation by scum suppression nozzles.
- 4-Heat exchangers, single pass, external spiral type, heated by recirculation of engine jacket water.

Gas System

- 1-Hortonsphere, 60 ft. diam. with a capacity of 565,000 cu. ft. at 75 psi.
- 4-Waste gas burners.
- 4-Gas Compressors, inlet volume 684 cu. ft/min each.

Process Water Plant

- 4- 125 hp pumps, 2,700 gpm used to fill reservoir and to maintain a prescribed level of water for efficient plant operation.

Deer Island Treatment Plant

PRINCIPAL EQUIPMENT

Process Water Plant (cont'd)

2-Traveling water screens.

2-Andale strainers.

1-1,000 lb/day capacity chlorinator used to chlorinate salt water being pumped to reservoir.

Chlorination

7-Chlorinators, each of 8,000 lbs/day capacity, providing pre and post chlorination.

1-Chlorinator 2,000 lbs/day capacity.

2-Weighing bays for 16 ton liquid chlorine containers, each scale capacity 100,000 lbs.

Outfalls

1-9' x 10' main outfall section terminating in President Roads at approximately 50 ft depth, mean low water.

1-6' x 6 $\frac{1}{2}$ ' main outfall section terminating in President Roads at approximately 50 ft depth, mean low water.

1-6-ft diam. emergency relief off-shore outfall.

1-9-ft diam. emergency relief off-shore outfall

1-9-ft diam. emergency relief off-shore outfall (Additional)

Note: Emergency relief outfalls controlled by gate operation to accommodate storm flow conditions only.

Administration Building

Engineering and Drafting Offices

Clerical Offices

Chemical and Bacteriological Laboratory

First Aid Room

Assembly and Lecture Room

METROPOLITAN DISTRICT COMMISSION

Sewerage Division

Allison C. Hayes, Director and Chief Sewerage Engineer
James W. Connell, Superintendent

NUT ISLAND SEWAGE TREATMENT PLANT

ANNUAL REPORT

July 1, 1975 to June 30, 1976

GENERAL INFORMATION

The Nut Island Sewage Treatment Plant, in operation since 1952, presently serves twenty-one cities and towns, including portions of Boston, Brookline, Hingham, Milton and Newton, covering an area of 237.59 square miles, having a total population of 789,365 and a contributing population of 653,070.

Designed to remove floating solids and grease and reduce the amount of suspended solids to such an extent as can be done in sedimentation tanks having 90 minutes' detention, the plant has been operating effectively as the first completed treatment unit in the overall Metropolitan District Commission's \$130,000,000 pollution abatement program.

The treatment processes include pre-chlorination, coarse screening and grit removal for incineration, pre-aeration of the influent for a 20-minute period, primary sedimentation, and post-chlorination of plant effluent prior to discharge through 60" outfall pipes some 6000 feet off shore in deep tidal water.

Treatment of the raw sludge is accomplished by modified high rate digestion. Two primary tanks, which have fixed covers, and one primary tank--with floating cover--are equipped to maintain continuous recirculation of the tank contents. A secondary digestion tank of the same capacity is equipped with a floating cover and supernatant draw-off. The digested sludge is disposed of through a 12" submarine pipe line which extends a distance of 4.2 miles from the treatment plant into deep tidal water on the south side of President Roads.

Gas produced by the digestion process is the principal source of fuel for all plant power and heating purposes. One or more of the six waste gas burners, provided for burning excess gas, are in continuous service.

Special features of plant design are:

1. The first installation of dual fuel engines to furnish all power used throughout the plant. The engines, having a total of 3000 horse power, operate equally well on either methane gas, which is a by-product of the digestion process, or on fuel oil.

2. 2 - 200 H. P. liquid rheostats for wound rotor motor speed control, effecting variable speed of main sewage pumps.
3. Multiple hearth incineration of sewage screening and grit and the scum formed in the digesters.
4. Pre-aeration of the raw sludge, to aid in grease removal and prevent the formation of objectionable sleek areas on the harbor waters, was another important "first".
5. The use of individual 36" and 42" comminutors for homogenization of sewage solids.
6. High-rate recirculation in primary digesters, with external heating for scum control and uniform digestion with an average detention rate of sixteen days.
7. Chlorinating facilities arranged for pre and post-chlorination.
8. Digested sludge line cleaner, used for annual cleaning of 4.2 miles long, 12" diameter submarine pipe line. Resembles a porcupine in appearance, and is nicknamed "The GO-Devil".
9. The first installation of the vertical torque flow solids pump for grit sump and grit channel dewatering.
10. Raw sludge line cleaner device, located in the Digester Building. Of special design and construction, this device maintains more than one-half mile of 6" diameter raw sludge line piping in a clean, workable condition.
11. Two 3 c.f. capacity pneumatic screenings ejectors, and one 25 c.f. grit and scum pneumatic ejector.

Plant design and construction were under the jurisdiction of the MDC Engineering * Division. Its operation and maintenance are the responsibility of the Sewerage Division.

* Formerly Construction Division

METROPOLITAN DISTRICT COMMISSION
Sewerage Division

A. C. Hayes, Director and Chief Engineer
James W. Connell, Superintendent
Vincent A. Palombo, Charge of Laboratory

N U T I S L A N D S E W A G E T R E A T M E N T P L A N T

Summary of Operating Data
July 1, 1975 to June 30, 1976

FLOW PROCESSES

Gallorage

Sewage flow, m.g.d., average - actual	123.18
" " " average - design	112.00
" " " maximum - actual	144.90
" " " maximum - design	300.00
" " " minimum - actual	105.46
" " m.g. Total	45,099.56

Grit

Removed, c.f., total	37,342.
c.f./m.g.	0.83
Volatile Content as collected, %	41.2

Screenings

Removed, c.f., total	9,388.
c.f./m.g.	0.21

Incinerator Ash, % Volatile

	0.0
--	-----

Total Suspended Solids

Influent, ppm	209.
Effluent, ppm	113.
Removal, %	45.9
Lbs./day	98,590.

Settleable Solids

Influent, ml/L	9.2
Effluent, ml/L	1.2
Removal, %	87.0

B.O.D., 5 day (1)

Influent, ppm	147.
Effluent, ppm	122.
Removal, %	17.0
Lbs./day	25,700.

Summary of Operating Data

Grease, pet. ether, soluble		
Influent, ppm	. . . . .	32.5
Effluent, ppm	. . . . .	22.5
Removal, %	. . . . .	30.8
lbs./day	. . . . .	10,300.
Chlorine Requirement (2)		
Influent, ppm	. . . . .	8.3
Effluent, ppm	. . . . .	8.0
Chlorine Residual		
Effluent, ppm, orthotolidine	. . . . .	1.3
Days Maintained	. . . . .	366.
Bacterial Concentration		
Influent, Millipore Filter/100ml	. . . . .	13,400,000.
Effluent, Millipore Filter/100ml	. . . . .	600.
Removal, %	. . . . .	99.996

II SLUDGE COLLECTION AND DIGESTION PROCESSES

Raw Sludge		
Total Solids, Content, %	. . . . .	5.07
Added to Primaries		
1000 gallons	. . . . .	78,921.65
1000 dry lbs.	. . . . .	33,079.69
Volatile Solids, Content, %	. . . . .	79.1
Added to Primaries		
1000 dry lbs.	. . . . .	26,164.45
Grease, Skimmings excluded, pet. ether soluble		
Content, %	. . . . .	12.7
Added to Primaries		
1000 dry lbs.	. . . . .	3,870.10
Sand, Content, %	. . . . .	12.5
Added to Primaries		
1000 dry lbs.	. . . . .	41,347.10
Alkalinity, ppm	. . . . .	300.
pH	. . . . .	6.05
Digested Sludge (3)		
Total Solids, Content, %	. . . . .	2.13
Withdrawn, 1000 gals.	. . . . .	75,813.
1000 dry lbs.	. . . . .	13,451.00
Volatile Solids, Content, %	. . . . .	58.7
Withdrawn 1000 dry lbs.	. . . . .	7,895.97
Grease, pet. ether soluble		
Content, %	. . . . .	6.41
Withdrawn, 1000 lbs.	. . . . .	862.00

Summary of Operating Data

Digested Sludge (cont'd.)		
Sand, Content, %	. . . . .	26.3
Withdrawn, 1000 lbs.	. . . . .	3,537.72
Alkalinity		
	. . . . .	2,300.
pH		
	. . . . .	7.10
Digester Scum Withdrawn		
Solids, 1000 dry lbs.	. . . . .	312,000.
Grease, 1000 dry lbs.	. . . . .	37.95
Non-saponifiable grease, 1000 dry lbs.	. . . . .	17.43
Digestion Efficiency (based on hi-rate single stage)		
Reduction		
Total Solids destroyed, %	. . . . .	50.1
1000 dry lbs.	. . . . .	16,571.92
Volatile Solids, destroyed, %	. . . . .	63.2
Loadings		
Detention, days	. . . . .	31.9
Unit Loading Rate, dry lbs/c.f./day	. . . . .	0.098
Digester Gas (4)		
Produced, total, 1000 c.f.	. . . . .	225,135.00
c.f./lb. solid added	. . . . .	6.8
c.f./lb. volatile added	. . . . .	8.6
c.f./lb. solid destroyed	. . . . .	13.6
Quality, Methane, %		
	. . . . .	57.2
Carbon Dioxide, %	. . . . .	40.1
Hydrogen Sulphide, grs./100 c.f.	. . . . .	96.

- (1) Influent under influence of pre-chlorination - six months.
- (2) Includes effect of pre-chlorination rates, 1500-3000 lbs./day.
- (3) Combined overflow and digested sludge to sea.
- (4) Gas from #4 Digester not metered. Gas production from #4 Digester calculated from lbs. of sludge destroyed.

NUT ISLAND SEWAGE TREATMENT PLANT

PRINCIPAL EQUIPMENT

GRIT ROOM

- 2 - Medium bar screens, 7/8" openings mechanically cleaned, rake speed 10 fpm.
- 6 - Grit channels, 80'x10'5", vel. .75 to 1.04 fps - conventional bucket and chain 80 cf/hr. cap. Grit conveyor belt 18"x75', 200 cf/hr. min.
- 3 - Dewatering Pumps:
 - 2 - of 150 gpm
 - 1 - Vertical Wemco of 250 gpm
- 1 - Raw Sewage Sampler.
- 1 - 36 ton/day multiple hearth incinerator
- 2 - 3 cf pneumatic screening ejectors
- 1 - 25 of pneumatic grit ejector
- 1 - 80 CFM, 125 psi air compressor

COMMINUTOR ROOM

- 4 - Comminutors, 36" size, having 3/8" openings - each of 26 mgd cap.
- 2 - Comminutors, 36" size, having 3/8" openings - each of 20 mgd cap.
- 3 - Comminutors, 42" size, having 3/8" openings - each of 40 mgd cap.

MAIN ENGINE AND PUMP ROOM

- 2 - Mixflo sewage pumps, 80 mgd at 10.3 TDH and 190 RPM driven by 200 H. P. variable speed wound rotor motors.
- 2 - Mixflo sewage pumps, 80 mgd at 10.3 TDH, driven by constant speed 190 rpm synchronous motors.
- 2 - 200 H. P. 400 volt liquid rheostats for wound rotor motor speed control.
- 1 - 850 H. P. straight gas engine to 750 KVA, 2300 V, 360 RPM alternator.
- 1 - 820 H. P. dual fuel engines to 740 KVA, 2300 V, RPM alternators.
- 1 - 630 H. P. dual fuel engine to 450 KVA, 2400 V, 514 RPM alternator.
- 2 - 213 H. P. dual fuel engines to 5000 cfm blowers.
- 1 - Horizontal exhaust heat boiler, 1,200,000 Btu/hr. cap.

METERING

- 1 - 120" x 60" Venturi meter.

PRE-AERATION SYSTEM

- 5 - Aeration tanks:
 - 4 - Parallel, 166' x 21' x 14'
 - 1 - Series, 85' x 12' x 14' - swing arm diffusers @ .1 cf/gal.
Detention: 7 min. avg., 25 min. max., equipped with spargers.

SEDIMENTATION

- 6 - Sedimentation tanks, 185' x 68' x 13', conventional flights and chains,
Detention periods in minutes: 30 min., 90 avg., 210 max.

Scum collection by special paddle conveyors with return to grease collection pit at head end of tank.

- 3 - Sludge Pumping Stations - each equipped with 2--300 gpm positive displacement plunger pumps and 1 torque flow type pump.

DIGESTER BUILDING

- 2 - Primaries, 100' dia. x 30', cap. each 2,300,000 gal., fixed covers, with continuous recirculation of tank contents, heated by external heat exchangers.
- 1 - Primary, 100' dia. x 30', 2,300,000 gal. cap., with floating cover; and gas recirculation system for mixing contents.
- 1 - Secondary tank--same size and cap., heated, equipped with floating cover and supernatant selector.
- 2 - Heat exchangers, single pass, series type, heated by recirculation of engine jacket water.
- 1 - Raw sludge line cleaner, consisting of 5,000,000 Btu/hr., heat exchanger and high cap. pump of special design.
- 1 - Gas recirculation system, cap. 300 CFM @ 10 psi.

GAS SYSTEM

- 1 - Hortonsphere, 90,000 c.f. capacity at 30-lb. pressure.
- 6 - Waste gas burners, 6,000 c.f./hr.
- 5 - Gas compressors:
 - 3 - at 150 cf/hr.
 - 2 - at 75 cf/hr.

OUTFALLS

4 - Outfalls:

2 Effluent, 30' depth, 5' dia., 6000' long.

1 Effluent, 20' depth, 5' dia., 1400' long.

1 Effluent, (offshore emergency) 5' dia., 468' long.

1 - Digested sludge disposal line, 12" dia., 4.2 miles long.

Chlorination

4 - Chlorinators of 8,000 lb/day cap., providing pre and post-chlorination.

ADMINISTRATION BUILDING

Storage facilities for 45-ton containers liquid chlorine.

First Aid Room

Chemical and Bacteriological Laboratory

Clerical Offices

2 - Boilers, vertical, fire tube, dual fuel fired, 3,000,000 Btu/hr. each.

1 - 0-5 ppm Chlorine residual analyzer.

SUMMARY OF PLANT OPERATING DATA

COTTAGE FARM STORM WATER DETENTION AND CHLORINATION STATION

From July 1, 1975 to June 30, 1976

The Cottage Farm Storm Water Detention and Chlorination Station was activated May, 1971, and is located on the Cambridge side of the Charles River just west of the Boston University Bridge. It receives the excess storm flow from combined sewers in Cambridge, Brookline and the South Charles Relief Sewer. The normal dry weather flow and minor storm flow up to capacity of the sewer will continue to flow to the Ward Street Headworks and then to the Deer Island Sewage Treatment Plant. The design flow of the Cottage Farm Storm Water Detention and Chlorination Station is 233.1 m.g.d.

No. of Times Plant was Activated	73
Total Amount Received by Station	991.25 Million Gallons
No. of Times Overflow Occurred into the Charles River	52
Total Amount of Overflow into the Charles River	896.35 Million Gallons
Total Amount of Sodium Hypochlorite Used	38,310.00 Gallons
Minimum Rainfall	.0.3 Inches
Maximum Rainfall	3.6 Inches
Average Rainfall	1.00 Inches

OPERATIONAL DATA *

BOD, 5 Day

Influent - ppm	108.39
Effluent - ppm	55.49
Removal, %	48.81%

Suspended Solids

Influent - ppm	115.76
Effluent - ppm	52.05
Removal, %	55.04%

Setteable Solids

Influent - ml/l	3.44
Effluent - ml/l	0.98
Removal, %	71.51%

Baterial Concentration (Total Coliform)

Influent - MF/100 ml	3.1×10^6
Effluent - MF/100 ml	<1000
Removal, %	99.99%

* Based on Composite Samples From Actual Discharges

STORM WATER DETENTION AND CHLORINATION STATION

Plant Designed for 233.1 MGD

1. One Electric Motor Driven Pump

Pump: Fairbanks Morse 30 inch size
Capacity: 28,000 GPM (40 MGD)
Total Head: 35 feet
Speed: 436 RPM

Electric Motor:

Manufacturer: Westinghouse Electric Corp.
Rated HP: 300
RPM: 450 (no load)
Shaft: Vertical Solid

Direct Drive

2. Three Diesel Engine Driven Pumps

Pump: Fairbanks Morse 42 inch size
Capacity: 60,000 GPM (86 MGD)
Total Head: 35 feet
Speed: 310 RPM

Diesel Engine

Manufacturer: Waukesha Motor Co.
Rated HP: 702 RPM 1200 (666 HP at 1140 RPM)
Shaft: Horizontal

Right Angle Gear Drive

Manufacturer: Philadelphia Gear Corp.
Rated HP: 610 RPM 1140 (input)
Ratio: 3.67 to 1

3. Emergency Diesel Electric Generator

Manufacturer: Kohler
Rate HP: 160 RPM 1800
Output: 93.75 KVA 75KW

4. Chlorination Equipment

Manufacturer: BIF

4 feeders, one for each pump

Feed rate of feeders controlled proportionally by
flow from discharge of pumps through Dall tubes.

Chlorine Residual Analyzer provides final trim on feeders.

Sodium Hypochlorite (15% strength) is used and stored
in two 4200 gallon fiberglass tanks.

5. Control System

Manufacturer: Autocon

Bubbler tube system working off of air pressure will automatically start and stop each pump and vary pumping rate according to water level in wet well.

6. Screens

Manufacturer: Jeffrey

Coarse Screens:

Quantity: 3
Type: Catenary
Clear Spacing Between Bars: $3\frac{1}{2}$ inches
Rate: 10 feet per minute
Channel Width: 4 ft. 6 in.
Max Flow Thru One Screen: 120 MGD

Fine Screens:

Quantity: 3
Type: Catenary
Clear Spacing Between Bars: $\frac{1}{2}$ inch
Rate: 10 feet per minute (motor can be rewired for
20 feet per minute)
Channel Width: 9 ft. 0 in.
Max Flow Thru One Screen: 120 MGD

7. Wet Well

Length: 72 feet
Width: 40 feet
Depth: Approximately 20 feet (depth varies)
Capacity: Approximately 350,000 gallons

8. Detention Tanks

Quantity: Six
Length: 108 feet
Width: 27 feet
Depth: 8 feet (average - varies)
Capacity: 175,000 gallons (approximate)

Overflow from detention tanks must pass through
No. 4 mesh (0.2 in. x 0.2 in. screens)

9. Outfalls

Overflow into Charles River Basin distributed through three diffusers:

- a. 96 in. pipe to first diffuser, 100 ft. from north bank.
- b. 84 in. pipe from first diffuser to second diffuser.
Second diffuser 158 ft. from north bank.
- c. 72 in. pipe from second diffuser to third diffuser.
Third diffuser 298 ft. from north bank.

Contract No. 274-S

Electrical Repairs to 3 Electrical Alternators in the Main Building of the Nut Island Sewage Treatment Plant, Quincy, Massachusetts

This contract was awarded to the Westinghouse Electric Corp., of Needham, Massachusetts on August 7, 1974 at a bid price of \$4,660.00. It was signed on November 6, 1974 and accepted as complete June 11, 1975 at a cost of \$4,660.00.

Contract No. 292-S

Overhaul the Switchgear for Generator Room, Main Building, Nut Island Sewage Treatment Plant, Quincy, Massachusetts

This contract was awarded to the Electrical Equipment Maintenance Corp., Norwood, Massachusetts on January 8, 1975 at a bid price of \$19,560.00. It was signed on January 29, 1975 and accepted as complete on March 5, 1976 at a cost of \$19,460.15.

Contract No. S75-4

Installation of Hot Water Lines, Deer Island Sewage Treatment Plant, Boston, Massachusetts

This contract was awarded to the New England Pressure Tap Co., of Winchester, Massachusetts on May 1, 1975 at a bid price of \$9,650.00. It was signed May 29, 1975 and accepted as complete on August 21, 1975 at a cost of \$11,585.75.

Contract No. S75-5

Removing and Replacing Ventilating Ducts at the Nut Island Sewage Treatment Plant, Quincy, Massachusetts

This contract was awarded to the Winthrop Plumbing and Heating Company, of Winthrop, Massachusetts on August 7, 1975 at a bid price of \$21,000.00. It was signed September 4, 1975 and accepted as complete January 13, 1976 at a cost of \$21,000.00.

Contract No. S75-6

Removing Existing Daymark and Furnishing and Installing A Spindle Daymark at the Nut Island Sewage Treatment Plant, Quincy, Massachusetts

This contract was awarded to the George Byrne Company of Watertown, Massachusetts on June 9, 1975 at a bid price of \$3,340.00. It was signed on June 26, 1975 and accepted as complete on September 18, 1975 at a cost of \$3,340.00.

Contract No. S75-7

Oil Containment Structures at Charlestown, East Boston, Quincy,
and Braintree-Weymouth Pumping Stations

This contract was awarded to the Prime Construction Company, of Milton, Massachusetts on September 4, 1975 at a bid price of \$25,640.00. It was signed September 15, 1975 and accepted as complete on April 12, 1976 at a cost of \$25,640.00.

Contract No. S75-9

Alterations of Pumps No. 1 and 2 at the Charlestown Pumping
Station, Charlestown, Massachusetts

This contract was awarded to the Welding and Engineering Company of Boston, Inc. on November 21, 1975 at a bid price of \$23,750.00. It was signed on December 16, 1975 and accepted as complete on April 26, 1976 at a cost of \$23,750.00.

Contract No. S75-10

Installation of Structural Steel in Sedimentation Tanks 1
Through 6, Nut Island Sewage Treatment Plant, Quincy,
Massachusetts

This contract was awarded to the Bonacorso Construction Corp., of Winthrop, Massachusetts on October 16, 1975 at a bid price of \$124,625.00. It was signed on November 13, 1975 and not completed at the end of the fiscal year.

Contract No. S75-11

Repair to Nos. 2 and 3 Diesel Engines at Nut Island Sewage
Treatment Plant, Quincy, Massachusetts

This contract was awarded to the Worthington Service Corp., of Stoughton, Massachusetts on December 4, 1975 at a bid price of \$55,000.00. It was signed on January 8, 1976 and was not completed at the end of the fiscal year.

Contract No. S75-13

Repair of M.D.C. Sewer Main, Section 74, Stoneham, Massachusetts

This contract was awarded to Dan C. Marino, Inc., of Lynn, Massachusetts on December 18, 1975 at a bid price of \$9,930.00. It was signed on January 22, 1976 and accepted as complete on May 13, 1976 at a cost of \$16,355.00.

Contract No. S76-3

Installation of Carbon Dioxide Fire Extinguishing System,
Pumping Station and Power Plant, Deer Island Sewage Treat-
ment Plant, Boston, Massachusetts

This contract was awarded to the John E. Clougherty Company of Charlestown, Massachusetts on April 19, 1976 at a bid price of \$5,680.00. It was signed May 13, 1976 and not completed at the end of the fiscal year.

Contract No. S76-8

Installation of Chain Link Fence Enclosing Outfall Structures,
Deer Island, Boston, Massachusetts

This contract was awarded to the Northeastern Fence & Supply Corp. of Saugus, Massachusetts on April 29, 1976 at a bid price of \$4,324.37. It was signed May 25, 1976 and accepted as complete June 18, 1976 at a cost of \$4,324.37.

Contract No. R134479/00

Weymouth Fore River Relief Siphon Inflow/Infiltration Study

This contract was awarded to Metcalf & Eddy, Inc., of Boston, Massachusetts at a cost of \$169,000.00. It was signed on January 8, 1976 and not completed at the end of the fiscal year.

Contract No. R134480/00

West Roxbury, Brookline, Newton Sewer Relief Line Inflow/Infiltration
Study

This contract was awarded to the Energy and Environmental Analysis, Inc., of Boston, Massachusetts at a cost of \$63,125.00. It was signed on November 13, 1975 and not completed at the end of the fiscal year.

Contract No. R134481/00

Reading, Stoneham, Wakefield Sewer Relief Line Inflow/Infiltration
Study

This contract was awarded to Whitman & Howard, Inc., of Wellesley, Massachusetts at a cost of \$85,000.00. It was signed on December 30, 1975 and not completed at the end of the fiscal year.

APPENDIX

Information relating to areas, populations, local sewer connections and other data for the Metropolitan Sewerage District appears in the following table:

Metropolitan Sewerage District

Total Pop- ulation	Miles of Local Sew- er Connected	Estimated Pop- ulation Contri- buting Sewage	Ratio of Contri- buting Population to Total Popula- tion (Per Cent)	Connections Made with Metropolitan Sewers		
				Public	Special	MDC
2,180,074	5,145.57	1,980,083	90.83	896	928	38

Of the gross population (State Census of 1971) of 2,180,074 on December 31, 1975, 1,980,083 representing 90.83 per cent were on that date contributing sewage to the Metropolitan sewers, through a total length of 5,145.57 miles of local sewers owned by the individual cities and towns of the district.

These sewers are connected with the Metropolitan System by 846 Public, 928 Special, and 38 MDC connections. During the current year, there has been an increase of 58.35 miles of local sewers connected with the Metropolitan System.

TABLE I

METROPOLITAN SEWERAGE DISTRICT
Areas and Populations

Table Shows Ultimate Contributing Areas and Present Estimated Populations
Within the Metropolitan Sewerage District, as of December 13, 1975.

The Population of the Cities and Towns of the District, as given in the Table,
is based on the State Census of 1975.

City or Town	Area (Square Miles)	Estimated Population
Arlington	4.64	50,223
Ashland	9.40	8,906
Bedford (1)	1.54	5,971
Belmont	3.79	29,073
Boston	39.19	639,524
Braintree	13.44	36,822
Brookline	5.33	53,150
Burlington	8.97	24,306
Cambridge	5.42	102,095
Canton	17.73	18,114
Chelsea	2.06	25,066
Dedham	9.55	26,924
Everett	2.91	39,713
Framingham	22.50	65,564
Hingham (2)	2.50	6,555
Holbrook (3)	4.50	11,849
Lexington	15.78	32,477
Malden	4.20	55,814
Medford	5.98	60,702
Melrose	3.81	32,213
Milton	8.98	27,214
Natick	14.58	31,102
Needham	7.48	29,936
Newton	14.40	89,183
Norwood	10.14	31,316
Quincy	11.39	91,487
Randolph	6.25	29,206
Reading	9.05	23,696
Revere	5.55	41,292
Somerville	3.96	80,596
Stoneham	4.23	21,564
Stoughton	14.92	25,717
Wakefield	6.33	26,041
Walpole	20.31	18,504
Waltham	11.39	58,602
Watertown	3.82	36,075
Wellesley	9.89	26,593
Westwood	9.20	14,019
Weymouth	16.22	56,854
Wilmington	15.13	17,656
Winchester	5.31	22,672
Winthrop	1.59	20,359
Woburn	12.23	35,329
TOTALS	405.59	2,180,074

(1) June, 1970--Bedford became a member of the system. Sewage for part of the town handled through the Town of Lexington under special contract.

(2) The Area and Population given is only for that part of the Town included in the Metropolitan Sewerage District.

(3) Holbrook became a member of the system in January, 1971, but is not contributing sewage to the system.

TABLE II

TO DEER ISLAND

THE TOTAL AND CONTRIBUTING POPULATIONS ALONG WITH THE ULTIMATE SEWERED AREA OF EACH CITY OR TOWN CONTRIBUTING TO DEER ISLAND SEWAGE TREATMENT PLANT AS OF DECEMBER 31, 1975, ARE TABULATED BELOW

CITY OR TOWN	TOTAL POPULATION 1975 STATE CENSUS	CONTRIBUTING POPULATION	ULTIMATE SEWERED AREA SQUARE MILES
Arlington	50,223	50,189	4.64
Bedford	5,971	5,971	1.54
Belmont	29,073	27,868	3.79
Boston (Part Of)	475,614	475,267	22.23
Brookline (Part Of)	32,429	32,406	1.38
Burlington	24,306	19,204	8.97
Cambridge	102,095	101,955	5.42
Chelsea	25,066	25,045	2.06
Everett	39,713	39,691	2.91
Lexington	32,477	27,271	15.78
Malden	55,814	55,754	4.20
Medford	60,702	60,594	5.98
Melrose	32,213	32,145	3.81
Milton (Part Of)	2,238	2,248	0.42
Newton (Part Of)	38,893	38,882	6.28
Reading	23,696	17,451	9.05
Revere	41,292	39,448	5.55
Somerville	80,596	80,483	3.96
Stoneham	21,564	20,936	4.23
Wakefield	26,041	24,496	6.33
Waltham	58,602	43,837	11.39
Watertown	36,075	36,074	3.82
Wilmington	17,656	193	15.13
Winchester	22,672	22,671	5.31
Winthrop	20,359	20,340	1.59
Woburn	35,329	26,594	12.23
TOTALS	1,390,709	1,327,013	168.00

TABLE III

TO NUT ISLAND

THE TOTAL AND CONTRIBUTING POPULATIONS ALONG WITH THE ULTIMATE SEWERED AREA OF EACH CITY OR TOWN CONTRIBUTING TO NUT ISLAND SEWAGE TREATMENT PLANT AS OF DECEMBER 31, 1975, ARE TABULATED BELOW

CITY OR TOWN	TOTAL POPULATION 1975 STATE CENSUS	CONTRIBUTING POPULATION	ULTIMATE SEWERED AREA SQUARE MILES
Ashland	8,906	2,016	9.40
Boston (Part Of)	163,910	163,705	16.96
Braintree	36,822	36,760	13.44
Brookline (Part Of)	20,721	20,710	3.95
Canton	18,114	10,634	17.73
Dedham	26,924	24,249	9.55
Framingham	65,564	52,631	22.50
Hingham	6,555	4,447	2.50
Holbrook *	11,849	---	4.50
Milton (Part Of)	24,976	23,214	8.56
Natick	31,102	22,146	14.58
Needham	29,936	27,000	7.48
Newton (Part Of)	50,290	50,277	8.12
Norwood	31,316	31,284	10.14
Quincy	91,487	91,405	11.39
Randolph	29,206	13,809	6.25
Stoughton	25,717	9,754	14.92
Walpole	18,504	6,083	20.31
Wellesley	26,593	21,885	9.89
Westwood	14,019	5,770	9.20
Weymouth	<u>56,854</u>	<u>35,291</u>	<u>16.22</u>
TOTALS	789,365	653,070	237.59

Holbrook * -- became a member of the system January, 1971,
but is not contributing sewage to the system.

METROPOLITAN DISTRICT COMMISSION

Location, Length and Sizes of Metropolitan Sewers with Public, Special
and MDC Connections as of June 30, 1976

City or Town	Size of Sewers	Length in Miles	Public	Special	MDC
Arlington	10" to 66"	10.00	69	265	2
Ashland (4)	--	--	2	0	0
Bedford (7)	--	--	2	0	0
Belmont (1)	30" to 36"	--	3	0	0
BOSTON					
Boston (Proper)	10' to 11'-6"	0.43	2	0	0
Brighton	12" to 7'-0"x9'-4"	9.35	18	5	3
Charlestown	12" to 6'-7"x7'-5"	3.48	16	20	0
Deer Island	4' to 11'-6"	4.46	4	2	2 (3)
Dorchester	2'-6"x2'-7" to 3'-4"	2.90	19	13	1
East Boston	12" to 10'-0"	6.78	26	10	0
Hyde Park	30" to 10'-7"x11'-7"	4.73	20	8	0
Roxbury	3'-9" to 10'-0"	5.66	17	7	0
South Boston	10'-0" to 11'-6"	5.39	2	0	1
West Roxbury	12" to 9'-3"x10'-2"	10.35	36	22	2
Braintree	8" to 48"	4.26	9	2	0
Brookline	8" to 9'-0"	2.93	7	0	0
Burlington (5)	--	--	1	0	0
Cambridge	15" to 7'-4"x11'-6"	11.65	68	24	0
Canton	18" to 60"	7.82	16	31	0
Chelsea	15" to 11'-3"x11'-3"	6.83	28	9	2
Dedham	18" to 72"	8.38	17	6	0
Dover	48"	0.99	0	1	0
Everett	52" to 11'-3"x11'-3"	5.49	12	15	1
Framingham (1)	42"	0.01	3	0	0
Hingham	12" to 24"	0.14	1	0	0
Holbrook (6)	--	--	--	--	--
Hull (2)	12" to 60"	2.58	0	0	0
Lexington	15" to 33"	2.44	10	0	0
Malden	15" to 4'-6"x4'-10"	8.63	66	192	6
Medford	10" to 9'-3"x9'-3"	13.00	45	12	11
Melrose	10" to 4'-6"x4'-10"	6.09	43	142	0
Milton	8" to 11'-0"x12'-0"	7.12	37	4	0
Natick	42" to 48"	5.15	18	4	0
Needham	2'-0"x2'-3" to 54"	8.62	9	12	0
Newton	15" to 72"	5.08	25	26	1
Norwood	30" to 54"	4.67	11	13	0
Quincy	16" to 11'-3"x12'-6"	9.91	48	7	1
Randolph (1)	15" to 33"	0.01	1	0	0
Reading	16" to 36"	0.06	1	0	0
Revere	15" to 48"	0.14	3	0	0
Somerville	10" to 6'-5"x7'-2"	4.73	18	22	3
Stoneham	10" to 36"	4.04	18	4	1
Stoughton (1)	20"	--	1	0	0
Wakefield	12" to 30"	0.70	7	3	0
Walpole	2'-6"x2'-9"	--	2	0	0
Waltham	30" to 42"x48"	1.69	3	0	0
Watertown	12" to 72"	1.47	8	6	0
Wellesley	2'-0"x2'-3" to 48"	0.10	2	0	0
Westwood	30" to 36"	0.30	3	0	0
Weymouth	12" to 4'-9"x5'-0"	3.73	10	6	0
Wilmington (1)	30"	--	1	0	0
Winchester	15" to 5'-6"x5'-9"	14.41	35	22	1
Winthrop	9'-0" to 10'-0"	3.23	16	4	0
Woburn	15" to 4'-2"x4'-5"	5.64	7	9	0
TOTALS		225.57	846	928	38

(1) The Metropolitan Sewers extend but a few feet into the Town of Belmont, Framingham, Randolph, Stoughton, Walpole and Wilmington.

(2) Dover and Hull are not part of the Metropolitan Sewer District.

(3) Temporary.

(4) Ashland connected to MDC through Framingham sewers.

(5) Burlington connected to MDC through Woburn sewers.

(6) Holbrook is a member of the Sewer System but is not contributing sewage to the system.

(7) Bedford connected to MDC through Lexington sewers.

TABLE V

METROPOLITAN SEWERAGE SYSTEM

Table Showing Cities and Towns Delivering Sewage to this System; Approximate Miles of Sewers Connected; Estimated Population and Areas Now Contributing; Total Areas Ultimately to Contribute, and Present Population of Such Areas; Ratios of Present Contributing Areas to Ultimate Areas; and Ratios of Population Now Contributing to Present Total Population

Present Contributing Areas								Ratio of Contrib. Population to Total Population		
Cities or Towns	Miles of Local Sewers Connected	Sepa- Rate or Com- bined	Number of Con- nections With Local Sewers	(1)	Est. Popula- tion Now Contrib. Sewage	Total Population 1975 State Census	Est. Area Now Contrib- uting Sew- age (Square Miles)	Area Ulti- mately to Con- tribute Sewage (Square Miles)	Ratio of	Ratio of Contrib. Area to Ultimate Population
				Est. No. of Persons Served by a House Conn.					Contrib. to 1975 Total Pop- ulation Per Cent	
Arlington	116.08	S	11,837	4.24	50,189	50,223	4.64	4.64	99.93	100.00
Ashland	15.75	S	521	3.87	2,016	8,906	0.81	9.40	22.64	8.62
Bedford (2)	30.56	S	1,527	3.91	5,971	5,971	1.54 (8)	1.54 (8)	100.00	100.00
Belmont	75.60	S	6,683	4.17	27,868 (3)	29,073 (3)	3.53	3.79	95.86	93.14
Boston (7)	1,399.00	S & C	90,763	7.04	638,972 (7)	639,524 (7)	38.86	39.19	99.91	99.16
Braintree	125.68	S	9,167	4.01	36,760	36,822	6.06	13.44	99.83	45.09
Brookline	109.76	S & C	8,097	6.56	53,116	53,150	5.14	5.33	99.94	96.44
Burlington	109.16	S	4,487	4.28	19,204	24,306	5.70	8.97	79.01	63.55
Cambridge	142.28	S & C	20,597	4.95	101,955	102,095	4.96	5.42	99.86	91.51
Canton	54.58	S	2,581	4.12	10,634	18,114	2.73	17.73	58.70	15.40
Chelsea	39.83	S & C	3,859	6.49	25,045	25,066	1.37	2.06	99.92	66.51
Dedham	69.13	S	6,108	3.97	24,249	26,924	3.06	9.55	90.07	32.04
Everett	58.84	S	7,970	4.98	39,691	39,713	2.31	2.91	99.95	79.38
Framingham	185.71	S	13,814	3.81	52,631	65,564	8.86	22.50	80.27	39.38
Hingham (4)	18.90	S	1,123	3.96	4,447	6,555	0.79	2.50	67.84	31.60
Holbrook (9)	--	S	--	--	--	11,849	--	4.50	--	--
Lexington	133.57	S	7,253	3.76	27,271	32,477	6.34	15.78	83.97	40.18
Malden	96.81	S	11,425	4.88	55,754	55,814	4.20	4.20	99.89	100.00
Medford	110.12	S	13,031	4.65	60,594	60,702	5.13	5.98	99.82	85.79
Melrose	74.88	S	8,097	3.97	32,145	32,213	3.07	3.81	99.79	80.58
Milton	81.57	S	6,808	3.74	25,462	27,214	3.43	8.98	93.56	38.20
Natick	88.36	S	5,890	3.76	22,146	31,102	4.59	14.58	71.20	31.48
Needham	110.90	S	7,521	3.59	27,000	29,936	5.33	7.48	90.19	71.26
Newton	283.82	S	21,381	4.17	89,159	89,183	13.48	14.40	99.97	93.61
Norwood	92.06	S	6,504	4.81	31,284	31,316	4.50	10.14	99.90	44.38
Quincy	204.29	S	21,257	4.30	91,405	91,487	7.98	11.39	99.91	70.06
Randolph	59.11	S	3,615	3.82	13,809	29,206	2.95	6.25	47.28	47.20
Reading	73.32	S	4,486	3.89	17,451	23,696	3.86	9.05	73.65	42.65
Revere	76.61	S	9,460	4.17	39,448	41,292	3.66	5.55	95.53	65.95
Somerville	152.38	S & C	17,806	4.52	80,483	80,596	3.88	3.96	99.86	97.98
Stoneham	56.75	S	4,769	4.39	20,936	21,564	3.09	4.23	97.09	73.05
Stoughton	39.74	S	2,187	4.46	9,754	25,717	1.58	14.92	37.93	10.59
Wakefield	84.29	S	5,960	4.11	24,496	26,041	4.14	6.33	94.07	65.40
Walpole	32.89	S	1,502	4.05	6,083	18,504	1.47	20.31	32.87	7.24
Waltham (6)	137.19	S	11,416	3.84	43,837	58,602 (5)	7.21	11.39	74.81	63.30
Watertown	72.45	S	8,236	4.38	36,074	36,075	3.21	3.82	99.99	84.03
Wellesley	310.10	S	5,899	3.71	21,885	26,593	5.89	9.89	82.30	59.56
Westwood	33.27	S	1,568	3.68	5,770	14,019	1.63	9.20	41.16	17.72
Weymouth	121.82	S	8,363	4.22	35,291	56,854	6.36	16.22	62.07	39.21
Wilmington	2.89	S	55	3.51	193	17,656	0.15	15.13	1.09	0.99
Winchester	77.88	S	5,813	3.90	22,671	22,672	3.60	5.31	99.99	67.80
Winthrop	49.00	S	4,109	4.95	20,340	20,359	1.44	1.59	99.91	90.57
Woburn	118.64	S	7,149	3.72	26,594	35,329	6.11	12.23	75.28	49.96
TOTALS	5,325.57	S & C	400,694	4.94	1,980,083	2,180,074	208.64	405.59	90.83	51.44

(1) Estimated from Assessors' statement of the number of houses in each city or town on December 31, 1975 and the population from the State Census 1975.

(2) July, 1970, Bedford became a Member of the System. Sewage for part of the Town is handled through the Town of Lexington on special contract.

(3) Including two connections with McLean Hospital, having an estimated population of 1,413.

(4) Part of City or Town, only included in the System.

(5) Including connections with the Metropolitan State Hospital and Middlesex County Tuberculosis Hospital, authorized by Ch. 372 of the Acts of 1928, and Ch. 373 of the Acts of 1929, having an estimated population 1,845.

(6) Includes 3.65 miles of trunk sewer built by Waltham for the joint use of Waltham, Watertown, Metropolitan State Hospital and Middlesex County Tuberculosis Hospital, authorized by Ch. 372 of Acts of 1928, and Ch. 373 of the Acts of 1929.

(7) Including connection with Boston State Hospital, having an estimated population of 1,240 and Suffolk County House of Correction on Deer Island, having an estimated population of 298.

(8) Area served under present contract.

(9) Holbrook became a Member of the System in January, 1971, but is not contributing sewage to the system.

M.D.C. DEER ISLAND SEWAGE TREATMENT PLANT

1971 air photo shows: (1) administration building and laboratory, (2) pumping station, (3) power plant, (4) storage sphere for sewage gas used to operate the plant, (5) sludge digestion tanks, (6) sludge and scum thickening tanks, (7) sedimentation tanks, each 255 feet long and 103 feet wide, (8) chlorine building, (9) Winthrop Terminal Headworks and (10) water storage reservoir to supply cooling water for equipment. Not shown is the Deer Island Electron Research Facility using high energy electron treatment to achieve disinfection erected in 1975.

(Mass. Dept. of Public Works photo by Jerry Buckley)

